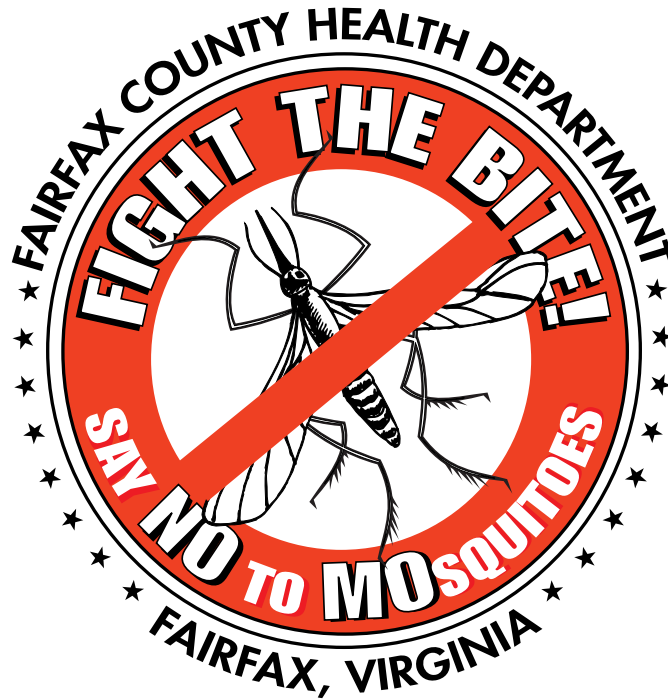


# *West Nile Virus*

*2003 Report and  
Comprehensive Prevention Plan for 2004*



Presented by

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**Fairfax County West Nile Virus Control  
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## **Abbreviations:**

BOS – Fairfax County Board of Supervisors  
CB(s) - Catch Basin (s)  
CDC - Centers for Disease Control and Prevention  
CDPH - Chicago Department of Public Health  
CEE - Central European Encephalitis  
CHS - Community Health and Safety  
CSF - Cerebrospinal fluid  
EHS – Environmental Health Specialist  
DC - District of Columbia  
DCLS - Division of Consolidated Laboratory Services  
DEET - N,N-diethyl-3methylbenzamide (an insect repellent)  
DIT - Department of Information and Technology  
DPWES - Department of Public Works and Environmental Services  
EEE - Eastern Equine Encephalitis  
EMG - Electromyography  
ELISA - Enzyme Linked Immunoassay  
FC - Fairfax County  
FDA - Food and Drug Administration  
FCHD - Fairfax County Health Department  
IgG-ELISA - IgG Enzyme-linked Immunosorbent Assay  
JE - Japanese Encephalitis  
KAP - Knowledge, Attitude and Practice  
LAC - LaCrosse virus  
MAC-ELISA - IgM Antibody Capture Enzyme-linked Immunosorbent Assay  
MWWOG - Metropolitan Washington Council of Governments  
MSMS - Mosquito Surveillance and Management Subcommittee  
OPA - Office of Public Affairs  
PRNT - Plaque Reduction Neutralization Test  
RT-PCR - Reverse Transcriptase Polymerase Chain Reaction  
SLE - St. Louis encephalitis  
TTY - Text Telephone  
ULV - Ultra Low Volume  
URL - Universal Resource Locator  
VA - Virginia  
VDH - Virginia Department of Health  
VDOT - Virginia Department of Transportation  
WN - West Nile  
WNV - West Nile virus

## Definition of Terms as Used in this Report:

**Adulticide** - An insecticide used to kill adult mosquitoes, usually applied by spraying.

**Asian tiger mosquito** - Common name for the *Aedes albopictus*.

**Catch basin** - Roadside inlet that permits rainwater to flow off the roadways.

**CDC trap** - A mosquito trap that attracts mosquitoes with light and CO<sub>2</sub> (produced by dry ice). A fan located below the light source sucks the mosquitoes into a collecting receptacle on the trap. The light is powered by a battery and the mechanism is protected by a metal roof. This type of trap collects mosquitoes attracted to humans (humans exhale CO<sub>2</sub> when they breathe).

**Common house mosquito** - In our area it is the common name given to *Culex pipiens*.

**Container breeder** - Mosquitoes that breed in artificial containers such as cans, bottles, tires, birdbaths and even catch basins.

**Day degrees above 75°F** - The daily cumulative number of degrees Fahrenheit above 75° during the year.

**DEET** - Chemical product in insect repellents that keeps mosquitoes away.

**Encephalitis** - Swelling of the brain (as can be caused by the West Nile virus).

**Gravid traps** - A mosquito trap baited with stagnant water that attracts female mosquitoes that seek this type of water to lay eggs.

**Larvicide** - An insecticide used to kill mosquito larvae.

**Medical community** - Health care providers.

**Meningitis** - Swelling of the membrane covering the spinal cord or membrane covering the brain (as can be caused by the West Nile virus).

**Mosquito dunks** - A larvicide that contains *Bacillus thuringensis israelensis* which is specific for mosquitoes, can be used by the community and is readily available over the counter.

**Mosquito larvae** - The aquatic stage of development in mosquitoes. This is the stage that hatches out of the mosquito eggs, lives in the water and is the most apt target of a mosquito management program.

**Mosquito pools** - A sample of mosquitoes that has been grouped together (thus pooled) to be tested for the presence of virus.

**Neuroinvasive** - Affecting the nervous system. Refers to the more serious forms of West Nile virus, meningitis or encephalitis.

**Ovitrap** - Traps set out specifically to collect eggs of container breeding mosquitoes, commonly used to monitor species such as the Asian tiger mosquito, *Aedes albopictus*.

**“Tip and Toss” campaign** - Part of Fairfax County WNV Program involving the community into removing standing water from their yards, thus reducing mosquito breeding habitats. The best way to eliminate the mosquitoes is to eliminate their breeding sources, standing water.

**VecTest** - A quick test to detect the West Nile virus in mosquitoes or birds. It is not as sensitive as PCR but is very good in WNV control programs.

**Vectolex** - A biological larvicide (*Bacillus sphaericus*) used in Catch Basins to proactively suppress mosquito populations.

**West Nile fever** - A febrile condition caused by the West Nile virus, very similar to the flu. The symptoms include fever, body aches, swollen glands, rash and headache.

**West Nile virus “off-season”** - The period of time (usually October to May) marked by low mosquito activity and no West Nile virus transmission.

**West Nile virus “season”** - The period of time (usually May to October) marked by high mosquito activity and West Nile virus transmission.

## **Acknowledgments**

We would like to thank the members of the Mosquito Surveillance and Management Subcommittee of the Environmental Coordinating Committee for their guidance, participation and comments in the preparation of this document.

The following documents were used in preparing this report and plan. Parts of the plan are modeled after plans of the Centers for Disease Control and Prevention (**CDC**), the Virginia Department of Health (**VDH**), the Metropolitan Washington Council of Governments (**MWCOG**) and the Chicago Department of Public Health (**CDPH**) 2002 WNV report.

### **CDC**

Epidemic/Epizootic West Nile virus in the United States: Revised guidelines for surveillance, prevention, and control.

<http://www.cdc.gov/ncidod/dvbid/westnile/resources/wnv-guidelines-aug-2003.pdf>

### **VDH**

VA WNV Surveillance & Response Plan, 2003

<http://169.134.196.45/epi/wnvsrcplan/AvianPlan.asp>

### **MWCOG**

West Nile Virus Response Plan for the National Capital Region

<http://www.mwcog.org/pdf/westnile2003.pdf>

### **CDPH**

West Nile Virus 2002 Interim Report and Comprehensive Prevention Plan for 2003

<http://www.cityofchicago.org/Health/WestNileVirus/WestNilePlan.pdf>

# **West Nile Virus: 2003 Report and Comprehensive Prevention Plan for 2004**

## **Executive Summary**

In the summer of 2003, North America continued to experience an increase in the number and spread of West Nile virus (WNV) infections. As of the April 7, 2004, 9,858 human cases with 262 deaths had been reported for 2003, as compared to 4,161 human cases with 277 deaths for 2002. The mid-western states of Colorado (2,947), Nebraska (1,942), South Dakota (1,039), Texas (717) and North Dakota (617) were the most affected. In Virginia, 23 human cases with one death were recorded (compared to 29 cases and two deaths in 2002), and Fairfax County reported three human cases with no deaths for the 2003 season compared to 13 cases and one death for 2002.

Fairfax County Health Department (FCHD) took the initiative in 2003 to enhance its WNV surveillance program and closely examine the activities of its contractor in order to maximize the protection to County residents. In addition, the County's Mosquito Surveillance and Management Subcommittee, a multiple agency committee with representatives from other jurisdictions covered by the Program, met regularly to ensure an aggressive response to WNV in order to reduce the impact of the virus on county residents.

This document reviews activities for 2003 and presents wide-ranging plans for minimizing risk of WNV infections in 2004.

The 2004 Comprehensive West Nile Virus Control and Mosquito Management Plan presented in this document is designed to minimize the impact of mosquito-borne diseases through 1) countywide surveillance measures and; (2) an integrated approach to mosquito management and control practices which will primarily target those mosquito species that have been shown to be the most probable WNV vectors in the County.

Like the 2003 WNV program year, it is anticipated that the emphasis of the 2004 program also will be on public outreach/education and aggressive larviciding to kill mosquitoes before they become biting adults."

The plan includes the following components:

### **Public Education and Community Outreach**

The County will increase public awareness of mosquito-borne disease risk, surveillance, prevention and control through the preparation and distribution of information via flyers, media interviews, advertising, Web pages, presentations to community groups, and collaboration with homeowners associations, other agencies, other jurisdictions and elected Board officials.

These education and outreach activities will be evaluated and measured through a knowledge, attitude and practice (KAP) survey which will allow the Program to focus on the more successful methods, and strengthen or modify those methods that require adjustments in order to ensure a greater impact.

In addition, outreach and educational material will be distributed in four languages other than English. These are Spanish, Korean, Chinese and Vietnamese.

### **Avian Surveillance**

Avian surveillance generally provides the first indication of West Nile virus activity in the County. Continuous monitoring will warn if there is any one place that has a cluster of dead (infected) birds at a

specific time. Crows, blue jays, cardinals and birds of prey will be monitored for WNV infection, with a focus primarily on dead birds. As an additional surveillance tool, the public will be asked to report dead birds by calling (703) 246-2300. Arrangements will be made with Animal Control in order to test all crows collected during the year. Initially, birds will be tested with VecTest in-house and then the samples will be sent for confirmation to the state laboratory in Richmond.

### **Mosquito Surveillance**

It is important to note that absolute high numbers of mosquitoes do not necessarily reflect high risk of human infection with WNV. The County will monitor mosquito populations countywide by collecting eggs and immature and adult mosquitoes. Priority for immature mosquitoes will be to identify and determine important breeding sites in order to target control measures. As in 2003, adult mosquito populations will be monitored for possible increase and viral activity. Mosquito samples will be tested for WNV throughout the County or at the state laboratory. Eggs of container breeding mosquitoes will be monitored in order to identify those localities where there are high population densities. Since many container breeding mosquitoes are found close to homes, these results will help us target the areas for education and outreach activities.

### **Environmental Considerations**

Weather records will be correlated with mosquito activity, in order to determine trends that may be useful in indicating higher risk of human infection.

### **Larval Mosquito Control—larviciding**

Catch basins, also called storm sewers or storm water catch basins (CBs), are located throughout the County. Catch basins usually drain well and do not present a problem as far as mosquito breeding; however, some (particularly those in older communities in the County) may have structural problems or may be partially blocked, retain water and produce excellent breeding sites for *Culex* mosquitoes.

Storm drain catch basins (CBs) will be treated with Vectolex in programmed cycles aimed at reducing mosquito populations. The first CB treatment cycle will begin in May, and the number of cycles will be dependent on climatic factors and mosquito surveillance results.

In larval breeding places where mosquitoes are detected and the breeding sites cannot be drained, larvicides will be applied. The Department of Public Works and Environmental Services (DPWES), with assistance of the FCHD, also will ensure larviciding of storm water retention ponds countywide.

FCHD will work closely with the Park Authority to manage vector mosquito populations when necessary. Nuisance mosquito breeding sites will not be routinely treated since it is not part of the Program, and no treatment of Park areas will take place unless there is a specific request by Park Authority and high larval densities of vector species are found.

### **Adult Mosquito Control**

A timely and appropriate response to surveillance findings can reduce the overall impact of WNV and prevent human disease. Consistent with CDC, VDH and MWCOG guidelines, FCHD will implement an appropriate level of response to these findings that will expand education, prevention and control activities. The response levels outlined in this document go from basic response to very heightened response ranging from level “0” to level “5”.

In the history of West Nile virus in the County, particularly in the past two years when we have had human cases, the use of insecticides against adult mosquitoes has not been necessary. However, if

surveillance data indicates that the level of WNV activity poses a significant threat to human health; adult mosquitoes will be controlled through the use of adulticides. Mosquito habitat, weather, time of year, and the proximity of infected mosquitoes to human populations will be considered in determining the necessity for adult mosquito control. FCHD will consult and coordinate with bordering jurisdictions, VDH and CDC as needed regarding spraying. If application of adulticides becomes necessary, FCHD will provide advance notice to the public and health care providers. Any targeted use of adulticides will be under the direction of the County Executive after consultation with MWCOG and the State Department of Health, and in coordination with any affected city or town within or adjacent to Fairfax County.

In order to categorize the use of adulticides in Fairfax County, any responses initiated by the FCHD can be grouped into five broad categories or levels of risk. These levels are tailored after those of CDC yet are modified to specifically reflect Fairfax County's position based on previous findings.

### **Level 0**

Definition: Fall/winter; vector inactive, climate unsuitable for WNV transmission.

Response: Prepare material and equipment for the upcoming WNV season. Surveillance and Control programs continue as outlined in the County's Surveillance and Control Plan. Identify locations where source reduction activities can be applied; secure surveillance and control resources necessary to enable response to WNV activity; initiate community outreach and public education programs; enhance communication with surrounding jurisdictions; recruit and staff, communicate and educate large property owners of the importance of source reduction in areas such as cemeteries, golf courses, country clubs; communicate status of WNV activity to director of the Health Department, the Board of Supervisors and the public as the WNV season starts.

### **Level 1**

Definition: Spring/summer/fall; anticipating WNV activity based on previous activity in region. No current surveillance findings indicating WNV activity in the area.

Response: Respond as in level 0, plus: continue and enhance source reduction, conduct larval control in identified breeding habitats where source reduction is not possible (emphasis will be placed on known *Culex* species breeding sites); continue community outreach and public education; begin monitoring avian mortality through surveillance system; initiate larval and adult mosquito surveillance; work with other county departments on source reduction and mosquito control activities; initiate Catch Basin treatment rounds.

### **Level 2**

Definition: Spring/summer/fall; initial, sporadic, or limited WNV activity in birds and/ or mosquitoes.

Response: Respond as in level 1, plus: increase larval control activities; continue source reduction in cooperation with other county departments; and increase public education, emphasizing personal protection measures, particularly the use of products containing DEET. Enhance human surveillance and activities to quantify epizootic activity (e.g. mosquito trapping and testing) in areas of concern. Consider recommending to the public that they decrease outdoor activities when mosquitoes are biting.

### **Level 3**

Definition: Spring/summer/fall; initial confirmation of WNV in human and/or horse, or moderate WNV activity in birds and/ or mosquitoes.

Response: Respond as in level 2, plus: expand public information programs (repellent use, personal protection, source reduction, risk communication about adult mosquito control program); prepare to implement adult mosquito control if surveillance findings indicate the likely potential for human risk to persist or increase.

#### **Level 4**

Definition: Spring/summer/fall; surveillance finding indicating high risk of human infection, (e.g. high or clusters of dead bird densities, high mosquito infection rates, multiple positive mosquito species, horse or other mammalian cases indicating increasing epizootic transmission, or a human case and high levels of epizootic activity) and abundant adult vectors.

Response: Respond as in level 3, plus: continue active surveillance for human cases; make final arrangements to implement adult mosquito control program in areas of potential human risk.

#### **Level 5**

Definition: Spring/summer/fall; marked increase of confirmed multiple WNV cases in humans and conditions favoring continued transmission to humans.

Response: Respond as in level 4, plus: implement or intensify emergency adult mosquito control program; monitor effectiveness of adulticiding on target mosquito populations; coordinate adult mosquito control activities with surrounding jurisdictions. FCHD activities related to adulticiding will include the following:

- CDC and gravid traps will be added to the treated area of concern if additional surveillance data are required.
- FCHD will work with experts and the contractor to design and implement feasible measures to monitor the efficacy of the adulticiding activities.
- The public will be notified of adulticide schedules in advance. This will allow residents with special health concerns sufficient time to take any precautions to reduce pesticide exposure (see Public Education and Community Outreach).
- Hospitals will be notified regarding the adulticiding schedule. Information on the pesticide that will be used will be provided to the public, physicians and other health care providers.
- Adult mosquito control will be scheduled when mosquitoes are active and when weather conditions are conducive to its success.
- Information will be released in advance through the media, the FCHD WNV Web site and through news releases, the MSMS, as well as pertinent County and community organizations.

# ***West Nile Virus: 2003 Report and Comprehensive Prevention Plan for 2004***

## **Background**

### **Public Health Impact**

Infection with West Nile virus causes illness in approximately one-fifth of people who are infected. The majority who are infected with the virus do not manifest any symptoms at all and may never know they were infected. In persons who do manifest symptoms, often the illness is relatively mild with fever, muscle aches, rash and headache. These cases, called “West Nile Fever,” are often undiagnosed and go unreported. In a small percentage of infected persons, more significant illness may occur such as meningitis, usually manifesting fever, headache and stiff neck; or encephalitis, which is accompanied with fever, headache, and confusion or muscle weakness. The more significant infections are usually severe enough to require hospitalization, and can be associated with prolonged recovery, disability, and even death. Treatment of West Nile virus infections is symptomatic since there is no specific drug that acts against it, and at present there is no human vaccine available.

Since 1999, when it first appeared in the United States in New York City, the range and impact of the West Nile virus has expanded every year. From 1999 through 2001, there were 149 cases of WNV human illness in the United States reported to CDC, including 18 deaths. In the summers of 2002 and 2003, North America experienced increasing epidemics of WNV infection. Large outbreaks occurred westward and 9,858 human cases with 262 deaths had been reported for 2003 (as of April 7, 2004), compared to 4,161 human cases with 277 deaths for 2002. In 2003 the mid-western states of Colorado (2,947), Nebraska (1,942), South Dakota (1,039), Texas (717) and North Dakota (617) were the most affected.

In Fairfax County, the first sign of WNV virus circulation was detected in 2000 when a single crow was found to be infected. In 2001, more birds were found infected and in 2002 the virus was found infecting birds, horses, mosquitoes and humans (Table 1). The age of the 2002 patients ranged from 4 to 86 years with a median of 57 years, 77% being males. Peak weeks for onset of illness occurred at the end of August to mid-September. The three cases in 2003 were middle-aged adult females, two exhibiting neurological manifestations, and the other one febrile WNV infection.

Table 1.- West Nile virus infections in birds, mosquitoes, horses and humans in Fairfax County, 1999 - 2003

Year	Bird	Mosquito	Human	Horse
1999	0	0	0	0
2000	1	0	0	0
2001	54	0	0	0
2002	70*	26	13/1**	3/1**
2003	15*	148	3	2/1**

\*Testing of birds was suspended after 70 positive birds were detected in 2002 and 15 in 2003.

\*\* cases / deaths

After finding an initial positive crow in 2000, many dead crows were reported in 2001 when 54 were found to be infected. In 2002, an intensive avian surveillance program was established and crows were actively collected until 70 were confirmed to be positive with WNV. At this point avian surveillance was suspended for the year. In 2003, a telephone line was set up to receive resident reports of dead birds in the County. In total 1,295 dead birds were reported. The distribution of dead birds reported was homogeneous throughout the County. Of the birds that were called-in, 367 were crows and 90 were blue jays. Only

crows and blue jays were tested for WNV since they are the known reservoirs of WNV. Testing birds for the virus was suspended after 15 positive birds were found since the results indicated that the virus was present throughout the county. Avian surveillance continued through the call-in line in order to monitor the distribution of dead birds throughout the County. Geo-referencing and mapping showed that these were also uniformly distributed throughout the County.

WNV is transmitted to humans by the bite of an infected mosquito. Mosquitoes in turn become infected when they feed on an infected bird, primarily those belonging to the family Corvidae which amplify the virus. Although many of the infected corvids (crows, blue jays) succumb to the infection, others survive. The infected mosquitoes then transmit WNV to other birds, humans and other mammals while taking a blood meal. After the virus is ingested by the mosquito it passes through the stomach wall into the body cavity where it replicates and eventually invades the salivary glands. During blood feeding, the mosquito injects saliva into the host and in this manner the virus is passed to the animal or human, at times, infecting these hosts.

In Fairfax County, *Culex pipiens*, *Culex restuans*, *Culex salinarius*, *Aedes albopictus* and *Ochlerotatus japonicus* are the species that may transmit the WN virus. *Culex pipiens*, also known as the northern house mosquito, has been the principal vector in 2002 and 2003 based on mosquito infection rates found. This mosquito species is a container breeder that prefers stagnant water rich in organic matter, such as that found in some storm water catch basins (CB). There it will lay its eggs from which the larvae hatch, turn into pupae and finally become adult mosquitoes. During the 2003 season, 21,335 mosquitoes were tested in 1,836 pools (samples), of which 148 were found to be positive for WNV. Of the mosquito species found to be positive, *Aedes albopictus* showed an infection rate of 0.25% (three positive pools of 1,211 specimens tested); *Culex pipiens* with an infection rate of 1.91% (119 positive pools of 6,224 specimens tested); *Culex restuans* with an infection rate of 0.61% (24 positive pools of 3,916 specimens tested); and *Culex salinarius* with an infection rate of 0.14% (two positive pools of 1,453 specimens tested).

#### Preparation and Planning for WNV in Fairfax County

West Nile virus has been found throughout the County in 2003, be it in birds, mosquitoes or humans. During the 2003 season, Fairfax County used a contractor to implement most of the WNV surveillance and control activities; however, the County is in the process of reassessing the distribution of these responsibilities and is planning to assume all surveillance activities in-house during the 2004 season. The County is undertaking a wide array of ongoing activities and new initiatives in order to enhance its preparedness for WNV prevention and mosquito control, and better understand the transmission dynamics of the virus.

Effective July 1, 2003, the majority of funding for the Fairfax County WNV program was placed in Fund 116, Integrated Pest management Program fund, giving it the resources necessary for stability and effectiveness through inclusion of the program in a special tax district.

Up to the end of the 2003 WNV season (October 2003), the Fairfax County Health Department (FCHD), in conjunction with its contractor, had a surveillance program in place for mosquito-borne viruses. Elements of the surveillance program included seasonal surveillance for evidence of mosquito-borne viruses in bird and mosquito populations. These activities were enhanced in the 2003 WNV season with the incorporation of a County entomologist.

Working with the contractor, the FCHD has monitored mosquito breeding sites in Fairfax County for two years. These breeding sites will continue to be monitored and treated as necessary when mosquito vector

populations are detected. The breeding sites of the principal *Culex* vector species will be treated with VectoLex® (*Bacillus sphaericus*) as determined necessary by the FCHD.

With the County taking over avian and mosquito surveillance, these surveillance activities will be expanded, giving greater coverage and sensitivity as well as direct control of the Program. Not only will the County take over the existing mosquito surveillance, but it will also increase the trapping effort throughout the County.

With the onset of WNV, FCHD has reviewed and updated public information materials in English. In order to meet the needs of other ethnic groups in the County, key elements of these materials have been translated into Chinese, Korean, Spanish and Vietnamese. Fact sheets, brochures and posters discussing actions Fairfax residents can take to reduce mosquito populations (by eliminating sources of standing water) as well as personal protection from mosquito bites were widely disseminated in 2003.

The Fairfax County Park Authority has been participating in the MSMS meetings and has specified that they would take all steps in addressing mosquito complaints from County residents. A system is in place that allows immediate actions whenever the Parks require more attention and participation from the Health Department.

### **Interim Report and Action Plan, by Activity**

#### **1. Risk Communication, Public Education, and Community Outreach**

*Goal: To increase the public's knowledge about WNV, its consequences and mosquito control as to modify their behavior in such a way that the community takes an active role in reducing the risk of WNV through the reduction of standing water and personal protection.*

In 2003, the County aggressively developed risk communication strategies and distributed public information material to encourage Fairfax County residents to eliminate and/or to treat standing water around homes, and to reduce their risk of infection by avoiding mosquito bites. Since most of the mosquitoes that bite around the house breed around the house, removing their breeding sites and using repellent will help reduce human – mosquito contact. Many news releases, news conferences and expert interviews with print and broadcast media in English, Spanish and Korean were used to disseminate prevention messages. More than 350,000 brochures with the slogan “Fight the Bite” were distributed through various routes including Board of Supervisors offices, libraries, mail, fairs, presentations, and some schools. Additionally, County mail was metered with a “Fight the Bite” seal, and flyers were included in water bills in Fairfax City. Information was provided regarding clinical spectrum of illness and prevention of WNV infection.

In all WNV public information messages sent out, the Health Department underscored that elimination of standing water and personal protection against mosquito bites were the key prevention activities for all County residents to protect themselves.

The Health Department ensured that WNV information was posted on the WNV Web page, which features its own URL (<http://www.fairfaxcounty.gov/fightthebite>). Fact sheets prepared by the FCHD were posted on the Web page, and ranged in topics from general WNV information to personal protection.

Hundreds of inquiries regarding WNV and mosquito breeding sites were received at the Community Health and Safety section of the Environmental Health Division of the Health Department, and promptly routed to staff for appropriate response and follow-up.

#### Planned Activities for Risk Communication, Public Education, and Community Outreach

Public outreach, information and education are mainstays of the WNV program in Fairfax County. We will continue to emphasize these during the 2004 season. All material will be reviewed and updated and new material will be prepared. In order to reach other ethnic groups within the community, key material will also be distributed in Spanish, Korean, Vietnamese and Chinese.

The FCHD, with assistance from the County's Office of Public Affairs (OPA) will be the lead agency on content for WNV publications, posters, etc., and will make this information available to all interested County agencies and pertinent jurisdictions. The County will continue with the "Fight the Bite" theme for the 2004 season (May to October).

#### Key Communication, Education and Outreach activities:

- News releases will be issued as deemed necessary and opportune.
- A communication plan of action will be developed.
- Key messages will include:
  - Explanation of County's comprehensive WNV Control and Mosquito Management Program.
  - Role of residents in personal protection and actions they can take to keep their homes free from breeding mosquitoes.
  - Importance of dead bird reporting and avian surveillance as a component of WNV program, as well as methods for disposing of dead birds by residents.
  - Importance of personal protection, emphasizing the use of DEET.
  - If adulticiding is necessary, clear and timely information with options for reducing exposure to pesticides as well as the procedures to be taken by the County.
- The impact of the material that has been used will be evaluated through a KAP survey (Knowledge, Attitude and Practice) of County residents at the beginning of 2004 (March–April). The analysis of the information gathered here will serve as a baseline for future studies and evaluations as well as orienting future outreach activities.
- Alternate media strategies used in other areas of the country will be evaluated and incorporated into the Program as feasible.
- Beginning mid-April to early May, public messages will be disseminated through news releases, interviews and public service announcements via all media outlets and opportunities possible. Most of the resources will be directed to elevate the population's awareness of WNV and steps individuals can take for personal protection. The multiple media outreach will include announcements in non-English language media as well.
- FCHD Program staff will work together with OPA and the offices of the Board of Supervisors to reach the constituents in each of the districts.
- Fairfax County Print Shop can produce outreach and educational material year-round as needed.
- During winter months, FCHD will review and update all the outreach material, prepare new material as needed and see to the translation and validation of that which is necessary. All material will be printed and prepared to be distributed in targeted groups.
- Posters, brochures (any & all printed materials) will be distributed at, by or through:
  - Fairs
  - Volunteers from the FC Volunteer program
  - Home owners associations

- Civic associations
- Inserting them along with water bills in the City of Fairfax
- Posters in public buildings
- Farmers markets
- Master gardeners
- “Fight the Bite” Web site [www.fairfaxcounty.gov/fightthebite](http://www.fairfaxcounty.gov/fightthebite)
- HD/Community Health and Safety (CHS) staff
- Clinic and physician waiting rooms
- Other distribution methods as they arise
- During special events and through the offices of the Board of Supervisors:
  - The use of Mosquito Dunks and other larvicides will be presented to the communities as an option for larval reduction in areas where the “tip and toss” campaign cannot be implemented.
  - The use of repellents containing DEET will be presented to the communities as an option for personal protection against mosquito bites.
- If surveillance information demonstrates potential for human risk of infection with WNV, media messages:
  - will emphasize personal protection against mosquito bites, using “Fight the Bite” recommendations
  - will help Fairfax residents ensure personal protection for themselves and family members
  - will target traditional media outlets as well as community newspapers in multiple languages and in multiple neighborhoods.
- If the available surveillance information suggests imminent and substantial risk to human health and adult mosquito control is recommended, FCHD will enhance its efforts to provide complete, timely, and accurate information on spray areas, spray schedule, and measures people can take to reduce exposure.
- Timeline of Activities:
  - In March, FCHD will review, adjust, prepare and print outreach and educational materials
  - In April and May, the County will prepare and provide WNV-related media stories
  - In June to October, as determined by mosquito and WNV activity detected, the “Fight the Bite” campaign to reduce infection by reducing mosquito bites will be intensified.

## **2. Human Case Surveillance**

Goal: a) To *categorize the community burden of West Nile virus meningitis or encephalitis in our community through disease tracking and trending analysis.* b) *To educate the medical community on WNV signs and symptoms, patient education opportunities, and laboratory testing.*

### **Introduction and Report of 2003 Activities**

In 2003, Fairfax County Health Department (FCHD) expanded its enhanced and active surveillance for arboviral encephalitis to improve the quality and timeliness of reporting and its ability to respond rapidly if any blood or organ recipients or newborns are at risk. An essential component of a suitable surveillance program for arboviral encephalitis includes rapid and complete laboratory diagnosis of all suspect cases.

Arboviral encephalitis is one of more than 70 reportable diseases and conditions in Virginia. Physicians are required to report all suspect cases to local health departments (including FCHD) in Virginia. However, physician reporting in general is not as reliable as laboratory-based reporting. Since most cases of arboviral encephalitis are diagnosed based on clinical criteria and the absence of bacterial pathogens on microbial testing of cerebrospinal fluid (CSF), significant under-reporting of arboviral encephalitis is likely.

To ensure detection of an early or late human case, enhanced passive surveillance for arboviral encephalitis was conducted by all jurisdictions in Virginia during November 2002 through June 2003. Active surveillance was implemented during peak months of mosquito activity and virus amplification (July through October 2003).

This plan may be updated as needed to reflect local surveillance needs or resources or guidelines from the Virginia Department of Health (VDH) or Centers for Disease Control and Prevention (CDC).

### Implementation Plan

#### Surveillance Activities for WNV Encephalitis

FCHD conducts enhanced passive surveillance for arboviral encephalitis during the season when mosquitoes are least active (November through June) and active surveillance during the season when mosquitoes are most active and peak amplification of the virus is occurring (July through October). Active surveillance may be implemented earlier if resources permit and WNV activity intensifies in avian, mammal or mosquito populations in an area.

#### Enhanced Passive Surveillance - Recommended for November through June

Alerting the medical community. Using information generated by the VDH Office of Epidemiology, the Centers for Disease Control and Prevention (CDC) and locally developed materials, FCHD alerts hospital infection control personnel and physicians regarding the importance of reporting suspected arboviral encephalitis, the criteria for reporting and instructions for submission of appropriate laboratory specimens. Physicians are encouraged to maintain a high index of suspicion for arboviral encephalitis in patients hospitalized with encephalitis of unknown etiology. In addition, cases of suspected Guillain Barr syndrome, botulism, and muscle weakness or flaccid paralysis should have WNV infection ruled out. Physician education materials include the importance of determining if there is a history of donating or receiving blood or organs or if the patient is pregnant or breast-feeding. Education materials are distributed by blastfax, Northern Virginia Medical Society Newsletter, FCHD Communicables Quarterly Newsletter, or other means determined necessary and effective.

Commercial laboratory surveillance. FCHD receives reports of sero-positive cases of WNV and other arboviruses tested by commercial laboratories from hospitals, physicians, Division of Consolidated Laboratory Services (DCLS) and the Office of Epidemiology. Since WNV may cross-react with Saint Louis Encephalitis (SLE) and other closely related flaviviruses on commercially available serologic tests, cases that are reported as SLE- positive or some other arboviral disease based on serologic testing are confirmed by DCLS. DCLS will perform highly specific IgM antibody capture enzyme-linked immunosorbent assay (MAC-ELISA) and IgG ELISA to identify SLE, Eastern Equine Encephalitis (EEE), LaCrosse virus (LAC), and WNV-reactive antibody. Reactive specimens will be tested for confirmation with a plaque reduction neutralization test (PRNT) either at DCLS or CDC. However, due to limited resources, testing by DCLS must be restricted to those patients who meet the clinical case definition for viral encephalitis. Many asymptomatic and mildly ill patients who have been bitten by mosquitoes may ask their physicians to test them for WNV. Even if infected, those with mild symptoms are likely to recover completely without the need for any specific medications and laboratory testing for WNV is not necessary. Should these patients develop more severe symptoms, such as confusion, lethargy, muscle weakness/paralysis, severe headache, or stiff neck, and therefore fit the criteria for WNV testing, appropriate specimens should be submitted to DCLS. Since there is no specific treatment for WNV, all

patients are treated symptomatically.

Active Surveillance – Recommended for July through October, or earlier if resources permit and WNV activity intensifies in an area. Viral meningitis or encephalitis should be included as an event FCHD monitors through syndromic surveillance systems.

Active surveillance by contact. FCHD contacts key medical staff (e.g., infectious disease, neurology or intensive care subspecialists) at acute-care hospitals to ask about potential cases of arboviral encephalitis and assure that appropriate laboratory specimens are obtained on all suspect cases and sent to DCLS for WNV and other arbovirus testing. In addition, cases of suspected Guillain-Barr syndrome, botulism, and muscle weakness or flaccid paralysis should have WNV infection ruled out.

### Surveillance Guidelines for Human Encephalitis

Recommended Criteria for Suspect Case of WNV - Any adult or pediatric patient with viral encephalitis (criteria a, b and c below) with or without associated muscle weakness (Criteria d)

- a. Fever  $\geq 38^{\circ}\text{C}$  or  $100^{\circ}\text{F}$ , accompanied by
- b. Altered mental status (altered level of consciousness, agitation, lethargy) and/or other evidence of cortical involvement (e.g., focal neurologic findings, seizures), and
- c. CSF pleocytosis with predominant lymphocytes and/or elevated protein and a negative gram stain and culture, and/or elevated protein and a negative gram stain and culture, and/or
- d. Muscle weakness (especially flaccid paralysis) confirmed by neurologic exam or by EMG.

### Transmission Issues

Recent evidence of organ transplantation and blood transfusion transmission of WNV make it important for FCHD to rapidly determine if any human cases of probable or confirmed WNV infection had an organ transplantation or blood transfusion within the four weeks prior to illness onset or was a blood donor during two weeks prior to illness onset. The VDH Office of Epidemiology should be notified immediately of potential transplantation/transfusion related cases. A trace back investigation of the cases will involve the CDC and the Food and Drug Administration (FDA).

Recent evidence of intrauterine and possible breast milk transmission makes it important to identify and monitor pregnant and breast feeding mothers if WNV infection is suspected. The VDH Office of Epidemiology should be contacted about such cases.

### Laboratory Testing for WNV

Suspect cases can be reported to FCHD or the VDH Office of Epidemiology using the Epi-1 reporting form or the initial case report form. If enhanced passive or active surveillance has been successfully initiated it should result in rapid and direct communication between medical care providers and FCHD. When reported, FCHD will screen reports to assess that the clinical presentation meets the case criteria for viral encephalitis and therefore for testing by the DCLS. As part of enhanced passive or active surveillance, FCHD will ensure that hospitals and laboratories have on hand and are aware of the latest surveillance criteria and information on how to submit diagnostic specimens for testing at the DCLS, when appropriate.

Since a negative reverse transcriptase polymerase chain reaction (RT-PCR) or enzyme linked immunoassay (ELISA) test on a specimen taken soon after illness onset (<8 days) does not rule out arboviral infection, convalescent sera are needed to definitively determine if WNV infection is present or absent. Therefore, FCHD will follow-up to ensure that convalescent sera are obtained on all suspected case-patients with encephalitis of unknown etiology if acute sera or CSF obtained <8 days after illness onset is negative for WNV. Negative results will result in a letter sent to the original collecting physician. Positive results will result in a phone call to the collecting physician to obtain convalescent sera. Positive results will be opened to Communicable Disease investigation. It is important that paired acute and convalescent phase serum samples are submitted to ensure accurate interpretation of the serologic tests.

The DCLS will perform all testing for WNV, including MAC-ELISA, IgG ELISA, on sera and CSF and RT-PCR on post mortem tissue and acute serum and CSF.

Health care providers will be informed that appropriate specimens for testing include:

- Sera - Appropriately timed acute and convalescent sera for testing by MAC-ELISA and IgG ELISA
- CSF - Testing by MAC-ELISA, real-time RT-PCR, or viral isolation
- IgM-positive sera should be confirmed by convalescent sera (MAC-ELISA and PRNT)
- Brain tissue – Real-time RT-PCR and viral isolation.

FCHD will encourage physicians and laboratories to complete all essential information on the laboratory submission forms by contacting appropriate parties, including the patient or patient's family, if necessary. Accurate interpretation of serological findings requires knowledge of the clinical history. For human specimens, it is important that the following data accompany specimens submitted for serology before results can be properly interpreted and reported:

- Symptom onset date (Critical information that frequently is not documented on the initial case report form)
- Date of sample collection
- Unusual immunological status of patient (immunosuppression)
- Current address and travel history in flavivirus-endemic area
- History of prior vaccination against a flavivirus disease (Yellow fever, JE, or CEE)
- Brief clinical summary including suspected diagnosis

Patient information and laboratory data will be shared between the VDH Office of Epidemiology and FCHD in person, via telephone and FAX and when available on a secure e-mail system to facilitate case surveillance and timely reporting of laboratory results back to FCHD. Results reported to FCHD on residents of other districts will be forwarded by fax or mail to the appropriate local health department (in VA and the DC metro area) or state health department (out of state residents). FCHD will maintain a database of all test results received.

FCHD will work with hospitals and physicians to encourage testing only for those patients that meet criteria for encephalitis. Patients with milder illnesses (e.g., fever and headache, fever and rash, fever and lymphadenopathy) or no symptoms (e.g., persons with a recent mosquito bite but no acute symptoms) do not need to be tested for WNV.

### **3. Mosquito Surveillance**

Goal: *To identify, treat and monitor Culex breeding sites, to monitor adult vector mosquito populations and their WNV infection rates in order to better predict risk to human populations, and to try to determine other factors associated that may influence WNV transmission to humans.*

It is important to note that absolute high numbers of mosquitoes do not necessarily reflect high risk of human infection with WNV. High mosquito counts, even if the mosquito species involved is one that may bite humans, are usually from large broods of floodwater “nuisance mosquitoes” such as *Aedes vexans*, which are less important than the *Culex* mosquitoes, transmitters of WNV. Fortunately, the house mosquito, *Culex pipiens*, feeds much less frequently on humans than *Ae. vexans*.

In the past FCHD has had mosquito surveillance in place with assistance of the contractor, Clarke Environmental Mosquito Control. Early in 2003, a full-time entomologist and two summer limited-term employees were hired by FCHD. The entomologist began a County-based program and trained the limited-term employees to trap mosquitoes (with CDC and gravid traps), to test mosquitoes in-house (with the VecTest) and to send other batches of mosquitoes to be tested for the presence of WNV and related viruses at the state laboratory (DCLS) in Richmond. The entomologist, with assistance of urban foresters from the Gypsy Moth and Canker Worm Program, identified mosquito species. The urban foresters also assisted in setting traps and VecTesting some mosquitoes. The amount of participation by the urban foresters depends entirely on their availability and the other duties that they have related to gypsy moth, cankerworm, emerald tree borer and other forest pests.

Clarke Mosquito Control has monitored known *Culex* breeding sites in Fairfax County for two years, creating a partial database of breeding sites. Fairfax Park Authority collaborated with the Program so that traps could also be placed in parks.

In 2003, FCHD monitored mosquito traps set throughout Fairfax County, during 1,180 trap-nights (a trap night is one trap set during one night). Of these, 786 were CDC trap-nights and 394 were gravid trap-nights. During this time, a total of 23,010 mosquitoes were collected in 37 species. The CDC traps collected 14,960 mosquitoes with representatives in all 37 species and the gravid traps collected 8,050 mosquitoes in 22 species. However, nine of the species collected in the gravid traps were only represented by one, two or three individual mosquitoes. Of the mosquitoes collected, 21,335 were tested for WNV in 1,836 groups (pools), of which 148 pools were found to be positive with WNV. Since each mosquito pool varied in number from one to 50, it is difficult to establish the exact number of positive individuals, but a preliminary study, in collaboration with DCLS and the Virginia Department of Health, suggests that the larger pools may have had up to three positive mosquitoes during peak transmission season.

Of all mosquitoes tested, only four species were positive for WNV. *Culex pipiens* exhibited the highest infection rate (1.91%), followed by *Culex restuans* (0.61%). Both of these species prefer to breed in stagnant water and – in Fairfax County – catch basins appear to be their preferred breeding sites. A third *Culex* species, *Culex salinarius* had an infection rate of 0.14%. *Aede albopictus* (the Asian tiger mosquito), that prefers to breed in manmade artificial containers around buildings, had an infection rate of 0.25%. The number of mosquitoes, groups and positive groups can be seen in Table 2 along with their infection rates.

**Table 2.- WNV infection rates in mosquitoes collected in Fairfax County**

<b>Species</b>	<b># of pools tested</b>	<b># of pools positive</b>	<b># of specimens</b>	<b>Infection rate (%)</b>
<i>Aedes albopictus</i>	169	3	1,211	0.25%
<i>Culex pipiens</i>	514	119	6,224	1.91%
<i>Culex restuans</i>	360	24	3,916	0.61%
<i>Culex salinarius</i>	172	2	1,453	0.14%

#### Planned Activities for Mosquito Surveillance

Realizing that it is not good practice to have a contractor carry out surveillance as well as control activities, the County in FY 2003 created a merit Entomologist position through a CE redirection of 1/1.0 SYE position to support and manage the WNV Program. This resulted in an evaluation of the contractor and the preparation of a program so that the county could carry out a more widespread surveillance program for less cost than it would incur to contract the services out.

- FCHD mosquito surveillance activities include:
  - Increase coverage of mosquito surveillance with more traps.
  - Associate mosquito trap data with risk factors, in order to assess how to predict human risk and refine “triggers” for mosquito control activities.
  - Begin to geocode and map the Catch Basins in the County since they appear to be the primary source of *Culex pipiens* and *Culex restuans* production.
  - Hire two biologists to eventually run all WNV surveillance activities in-house.
  - Prepare trap sites to be used during the 2004 season to ensure homogeneous coverage of the County.
  - Collaborate with the DIT to develop a computerized data system to optimize data on mosquito populations (larvae, adults) and infection rates (adults) in real time.
  - Ensure adequate routine inspection of suspected breeding sites to determine the presence of mosquito larvae. Sites with larvae will be treated as necessary.
  - Share information in a timely fashion with Clarke Mosquito, County agencies and neighboring jurisdictions regarding sites needing larvicide, as appropriate.
  - Collect and update larval habitat information throughout the season (May-October).
  - Trap adult mosquitoes from May to October at up to 80 permanent sites throughout the County. The trapping season may be lengthened or shortened depending on climatic conditions.
  - Collect mosquitoes using CDC light traps and gravid traps. Sort each trap collection by species of mosquito collected and record information on location, collection data, trap type and the total of number female mosquitoes.
  - Expand or enhance adult mosquito trapping in areas where WNV is detected in mosquitoes, birds, other animals or humans. This will help determine zones of potential local transmission and determine the extent of viral activity thus guiding interventions.
  - Increase frequency of mosquito trapping to evaluate the efficacy of the control measures in the event that pesticides are applied for adult mosquito control.
  - Deploy additional traps to monitor more intensely in areas where surveillance indicators suggest increase in WNV activity.

#### **4. Environmental Considerations**

Goal: *To monitor environmental factors (temperature, rainfall and photoperiod) in order to correlate them with surveillance results and WNV circulation to try to determine those factors that may influence WNV transmission.*

It appears that some of the most influencing factors in WNV transmission in 2003 were temperature, rainfall and photoperiod (day length). Moderate temperature prolongs the extrinsic development of the virus in the mosquito requiring a longer period for it to become infective. Lower temperature also prolongs the larval development of mosquitoes, keeping them in breeding sites for longer periods of time. Frequent and abundant precipitation creates a flushing effect of the Catch Basins washing out any mosquito larvae that may be there. Even though these rains may create more mosquito breeding sites above ground, these are not the preferred breeding sites for *Culex pipiens* in Fairfax County, yet they may increase *Aedes albopictus* populations. Photoperiod is believed to be a critical factor in breaking diapause (over wintering) in the principal WNV vector *Culex pipiens*. Even though photoperiod is a constant in our area, knowing how many day-hours are required to break diapause will allow initial Catch Basin treatment to be programmed in a timely manner.

In 2002, in Fairfax County, there were twice as many day degrees above 75°F (almost 300 degrees) than in 2003 and in 2003 there was twice as much rainfall (almost 60 inches) than in 2002. There were four times more human cases of WNV in 2002 than in 2003, suggesting that a hot, dry summer is more favorable for human WNV transmission than a cool, wet summer.

#### Planned Activities for Environmental Considerations

- Official weather data will be collected from Ronald Regan National Airport Weather Station on a daily basis and recorded electronically.
- Weather trends will be monitored through time and correlated with surveillance information to try to predict viral activity and human infection.
- Field experiments will be carried out in order to better understand the effect of weather on WNV transmission and infection rates.

### **5. Avian Surveillance**

*Goal: To use data on bird mortality and their WNV infection as an early indicator of WNV activity in Fairfax County, in order to predict the spread of the virus before the onset of human illness.*

Many species of birds have tested positive for WNV in the U.S.. Crows and blue jays are particularly susceptible to the disease, amplify the virus and are readily identified by the public. Consequently, these species are most closely monitored by public health agencies, including FCHD.

A call-in telephone line was set up for avian surveillance during the 2003 WNV season. It requested the caller to identify the kind of bird and the location where it was found as well as location characteristics. Select calls were returned and, based on the caller's information, recently-deceased crows or blue jays were confirmed and collected for testing.

During 2003, FCHD's call-in telephone line received 1,259 calls regarding dead birds. Of these, 367 were for crows and 90 were for dead blue jays. Some of these birds were collected and tested. The other 802 were either other species of birds or not enough information was provided. The birds were tested in-house with a VecTest, and oral swab samples were sent to DCLS (Richmond) for PCR confirmation. Evidence for WNV was found in 15 (13 were crows and two were blue jays). After collecting 15 positive birds, the MSMS decided to suspend testing for the year since the information was sufficient for determining that the virus was present throughout the County and the amount of resource required in continuing.

All dead bird locations called in were geocoded and mapped in order to determine clustering of dead birds or increase in reporting frequency. The only cluster observed, both geographically and temporally, was in

January in the Baileys Crossroads area where the federal government carried out a crow poisoning campaign to cull the flock. Mapping of all dead birds, crows and blue jays, as well as the positive birds, showed homogeneous distribution throughout the County. Temporal distribution of the dead birds showed a normal distribution that peaked in August, as well as the crow mortality spike in January.

Information on bird deaths was used to prioritize early mosquito surveillance activities and prevention efforts including public information about personal protection and standing water.

#### Planned Activities for Avian Surveillance

- As in 2003, FCHD will continue to monitor dead bird surveillance as reported by the public through the call-in phone line 703-246-2300, TTY 711 or by e-mail through the County's WNV Web page [www.fairfaxcounty.gov/fighthtebite](http://www.fairfaxcounty.gov/fighthtebite).
- A greater effort in collecting dead birds will be made in 2004, particularly early in the season since positive birds early on are suggested to be better indicators of future human cases.
- Although all birds may not be picked up, the reported dead bird information will be used by the FCHD to enhance its disease surveillance program.
- Clear public messages regarding bird testing and disposal will continue to be disseminated by all possible means.
- Throughout the year FCHD will geocode and map dead birds as reported on the call-in phone line. Mapping will be done for all birds, corvids as well as WNV positive birds. These maps will show geographical groupings of dead birds. This data will be compared to other WNV surveillance and control events.
- Throughout time, FCHD will graph the temporal distribution of dead birds reported to assess their distribution. This data will be compared to other WNV surveillance and control events.
- FCHD will use WNV positive bird reports as early indicators of WNV activity in the County.
- An appropriate sample of dead birds, especially crows and blue jays that have died within the previous 24 hours, will be tested for WNV.
- In cooperation with Animal Control, the FCHD will test crows and blue jays for WNV.
- All dead crows and blue jays that are tested will be tested first in house with a VecTest strip, and then samples will be sent to Richmond for confirmation.

### **6. Source Reduction (elimination of standing water)**

*Goal: To reduce the number of adult Culex species mosquitoes by eliminating potential breeding sites.*

#### Background

All mosquitoes begin their life in water. The Northern House Mosquito, (*Culex pipiens*), the primary vector of WNV in Fairfax County and one of the most common mosquitoes found in urban areas, breeds quickly and uses standing or slow-moving water containing decaying organic materials to lay eggs. Prime breeding sites include discarded tires left outdoors, poorly maintained bird baths, clogged rain gutters, poorly maintained swimming and plastic wading pools, pots and pans with standing water, and puddles that last for a week or more. Eliminating breeding sites is the simplest and most effective way to reduce the number of mosquitoes. Every residential and commercial property owner should regularly inspect their property and buildings to determine if conditions are conducive to mosquito breeding and endeavor to eliminate those conditions. Mosquito breeding can be prevented by either eliminating the standing water (source reduction), or if that is not possible, treating the water with larvicide to prevent mosquitoes from developing.

In 2003, the County's WNV Outreach and Public Education Campaign highlighted the need for residents to eliminate mosquito-breeding sites around their homes. Diagrams of potential sources around the home were described in multiple media events and on the Web site.

FCHD's Community Health and Safety (CHS) section received complaints regarding standing water and mosquito breeding and took the appropriate action to abate them. CHS staff also addressed backyard swimming pools upon complaint. Poorly maintained swimming pools were abated promptly, if not by the owner, by the health worker who then instructed the resident of proper mosquito control measures. The Department of Public Works and Environmental Services trained a group of its employees, who have subsequently passed their insecticide applicators license, in order to support the Program with the storm water detention ponds.

FHCD worked in collaboration with VDOT to correct highway ditches and to fix clogged/ blocked Catch Basins. Fairfax County Park Authority addresses all mosquito concerns in Park areas and any complaints that FCHD received were referred to Park staff. Most of the mosquitoes that were identified in Park areas were nuisance mosquitoes, and the WNV Program does not address nuisance mosquito problems.

#### Planned Activities for Source Reduction

- The CHS telephone line (703-246-2300) will continue as a method to receive resident complaints on mosquito breeding sites.
- The public will be asked to abate standing water or report it to 703-246-2300 if it is on public property.
- The WNV Program will work with home owner associations to promote community participation and distribute printed information on the need to eliminate mosquito-breeding sites on their property or to properly treat them with larvicide.
- The Fairfax County Park Authority will continue to manage all mosquito complaints in Park areas.
- FCHD will communicate with owners or managers of cemeteries, country clubs and other institutions of concern to develop a plan that addresses the abatement of standing water.
- DPWES will work closely with FCHD on mosquito problems in storm water retention ponds.
- FCHD will route mosquito issues in roadside canals and blocked Catch Basins to VDOT.
- In collaboration with Fairfax County Schools, mosquito populations will be monitored and controlled in the campuses in the County.

### **7. Larviciding**

*Goal: To reduce the number of adult Culex mosquitoes by applying environmentally safe larvicides in breeding sites that cannot be drained.*

#### Background

Catch basins, also called storm sewers or storm water catch basins (CBs), are located throughout the County. Catch basins usually drain well and do not present a problem as far as mosquito breeding; however, some (particularly those in older communities in the County) may have structural problems or may be partially blocked, retain water and produce excellent breeding sites for *Culex* mosquitoes. The exact number of CBs in the County is unknown, but it is estimated there are 75,000 to 100,000. Based on WNV data from 2002, FCHD worked with a contractor and began treating CBs in 2003 in predetermined areas that included most of the County. This area contained over 66,000 CBs. In order to better manage the number of CBs, areas were separated and managed by tax map grids. At the beginning of the summer, some of the CBs in newer areas were inspected and many were found to be in good shape (not containing water) so the map was redrawn for the second round of treatment. The new area contained approximately

33,000 CBs. The larvicide that we used was VectoLex (*Bacillus sphaericus*). *Bacillus sphaericus* is a naturally occurring soil bacteria that produces poisons which cause disease and death in mosquito larvae. It is considered ideal for mosquito management because of its specificity to mosquitoes and because of its very low toxicity to humans, domestic animals, wildlife, and the natural enemies of mosquito larvae. During the 2003 season 138,628 CBs were treated in three treatment cycles. The number of cycles in a season are dependent on several factors, including weather, degree of viral activity, resources, etc.

#### Planned Activities for Larviciding

- At present the WNV program is planning on four larviciding cycles, if needed, one more cycle than the previous year.
- During winter months, FCHD will carry out a survey of the County's storm water catch basins (CBs) geared at obtaining a more effective method of monitoring their treatment.
- The first round of CB treatment in 2004 (through the contractor) will be initiated in mid May and will follow the programmed CBs in the tax maps treated in the 1<sup>st</sup> round in 2003.
- The subsequent rounds of CB treatment will follow as determined by the FCHD based on all information gathered and will follow the maps that were treated during the 2<sup>nd</sup> and 3<sup>rd</sup> round in 2003 unless otherwise warranted.
- FCHD will purchase sufficient larvicide for the FCHD and Fund 116 staff to treat larval breeding sites as necessary to abate immediate problems.
- Through the contractor, FCHD will inspect and larvicide the previously identified breeding sites.
- Fairfax County Parks will not be treated (with larvicides) by the FCHD unless the action is specifically requested by the Park Authority. Handling of mosquito issues in Parks will be the responsibility of the Park Authority and all calls/complaints will be directed to 703-324-8555.
- FCHD will work in collaboration with DPWES in the surveillance and larviciding of storm water retention ponds.
- FCHD will verify WNV control and mosquito management plans of action through the regular meetings of the MSMS.
- FCHD will continue to monitor CBs outside the treatment area and treat them as necessary.

### **8. Operational Research**

*Goal: To carry out designed experiments in a scientific manner that will answer specific questions in operational research that will help understand and predict West Nile virus activity, resulting in a more effective approach to WNV control and mosquito management.*

#### Background

Because WNV has been recently introduced into the United States, it is behaving differently than it has in other regions where it occurs. FCHD plans to incorporate the use of any useful research findings in its routine actions. These actions have to be carried out with scientific methodology and criteria to determine their validity and usefulness.

#### Planned Activities for Operational Research

- Verify the importance of Catch Basins in the production of *Culex pipiens* in Fairfax County.
- Evaluate the usefulness of Zerofly<sup>®</sup> (a slow release insecticide impregnated fabric) in the control of mosquitoes in Catch Basins.
- Evaluate VectoLex<sup>®</sup> (*Bacillus sphaericus* in water soluble sachets) in Catch Basins

## **9. Adult Mosquito Control**

*Goal: To reduce the abundance of infected adult mosquitoes through the judicious use of pesticides in targeted areas when there is significant risk of mosquito-borne disease.*

### **Background**

While source reduction and the application of larvicides are the principal and most effective interventions to reduce mosquito populations, situations may arise in which infected, adult mosquitoes are present in significant numbers and pose a threat to human health. In these situations, judicious application of adulticides to control mosquito populations will be added to all other mosquito control activities as an additional measure to reduce risk of illness and death in humans. WNV guidelines from CDC state that adulticiding based on surveillance data is an extremely important part of any integrated mosquito management program and should be used when there is significant risk of human illness. To date there has not been an indicated need for adulticiding in the County.

Some of the insecticides that are used against adult mosquitoes include some synthetic pyrethroids and malathion (an organophosphate) that have been used for more than 30 years and are registered by the U.S. Environmental Protection Agency and the Virginia Department of Agriculture for adult mosquito control in residential areas. These insecticides provide a rapid knockdown, and kill adult mosquitoes upon contact. They also have low toxicity to mammals and birds, degrade rapidly in sunlight and water, and provide little or no residual activity. Most of these products do not bio-accumulate in animals. These adulticides are applied in very small quantities, a few ounces per acre, referred to as ultra low volume (ULV) application. ULV delivery techniques minimize undesirable environmental contamination while effectively managing adult mosquito populations.

Based on current (2002-2003) early human case surveillance and mosquito surveillance findings, FCHD has not yet identified any area in the County requiring use of this strategy. In the event that ULV adulticiding is necessary, the FCHD will work with VDH and CDC to define the areas in the County where risk of WNV infection to humans is highest and requires such action. Drivers and trucks from the contractor will be escorted down streets and roadways by police, and will apply adulticide to the defined areas.

All adulticiding activities will be carried out under the direction of the County Executive after consultation with MWCOC and the State Department of Health, and in coordination with any affected city or town within or adjacent to Fairfax County.

At a minimum, the following factors will be considered when deciding the scope of the adulticiding effort:

- The general ecology of the area, e.g., key habitat types and the presence of natural barriers such as large rivers;
- The population density, distribution, flight range, and age structure (proportion of parous females) of the target mosquito species;
- The flight range of the avian amplifying host(s);
- The length of time from when birds begin dying or become infected in the affected area (typically, there may be a lag of several weeks between recovery of dead birds and confirmation of WNV infection) or from when virus-positive mosquito pools are collected;
- The human population characteristics – spatial distribution and density relative to the positive locality (e.g., urban vs. rural), age demographics, etc.

- Evidence of persistent WNV activity detected by the surveillance program; season of the year and how long WNV activity can be expected to persist until the epizootic/epidemic vector(s) enter diapause.

### Planned Activities for Adult Mosquito Control

The presence of mosquito-borne pathogens in Fairfax County will result in one or more responses or interventions recommended by FCHD. These interventions can range from continuing existing surveillance, education and outreach to targeted application of adulticides.

FCHD will utilize its surveillance data to assess the risk of an outbreak of human disease and the need to apply insecticides in a limited and targeted area to control adult mosquitoes by considering habitat; time of year; weather conditions; the level of documented virus; the distribution, density, age and infection rate of the vector population; and the density and proximity of human populations. Because these conditions can vary greatly and cannot be predicted, a consultation process with VHD, CDC and surrounding jurisdictions will be used to determine which, if any, responses are appropriate, on a case-by-case basis.

If adulticides are used to control mosquitoes, advance notification will be widely disseminated on when and where the insecticides will be applied. This allows residents who wish to avoid exposure to take action to reduce exposure. The Virginia Poison Control Center, hospitals, and health care providers will be provided information on the pesticide being used. All insecticides considered for use will be from those registered with the U.S. Environmental Protection Agency and the Virginia Department of Agriculture and will be used according to the label directions. When choosing pesticides for mosquito control preference will be given to those insecticides that pose the least risk to humans and the environment.

In order to categorize the use of adulticides in Fairfax County, any responses initiated by the FCHD can be grouped into five broad categories or levels of risk. These levels are tailored after those of CDC yet are modified to specifically reflect Fairfax County's position based on previous findings.

#### **Level 0**

Definition: Fall/winter; vector inactive, climate unsuitable for WNV transmission.

Response: Prepare material and equipment for the upcoming WNV season. Surveillance and Control programs continue as outlined in the County's Surveillance and Control Plan. Identify locations where source reduction activities can be applied; secure surveillance and control resources necessary to enable response to WNV activity; initiate community outreach and public education programs; enhance communication with surrounding jurisdictions; recruit and staff, communicate and educate large property owners of the importance of source reduction in areas such as cemeteries, golf courses, country clubs; communicate status of WNV activity to director of the Health Department, the Board of Supervisors and the public as the WNV season starts.

#### **Level 1**

Definition: Spring/summer/fall; anticipating WNV activity based on previous activity in region. No current surveillance findings indicating WNV activity in the area.

Response: Respond as in level 0, plus: continue and enhance source reduction, conduct larval control in identified breeding habitats where source reduction is not possible, (emphasis will be placed on known *Culex* species breeding sites); continue community outreach and public education; begin

monitoring avian mortality through surveillance system; initiate larval and adult mosquito surveillance; work with other county departments on source reduction and mosquito control activities; initiate Catch Basin treatment rounds.

## **Level 2**

Definition: Spring/summer/fall; initial, sporadic, or limited WNV activity in birds and/ or mosquitoes.

Response: Respond as in level 1, plus: increase larval control activities; continue source reduction in cooperation with other county departments; and increase public education, emphasizing personal protection measures, particularly the use of products containing DEET. Enhance human surveillance and activities to quantify epizootic activity (e.g. mosquito trapping and testing) in areas of concern. Consider recommending to the public that they decrease outdoor activities when mosquitoes are biting.

## **Level 3**

Definition: Spring/summer/fall; initial confirmation of WNV in human and/or horse, or moderate WNV activity in birds and/ or mosquitoes.

Response: Respond as in level 2, plus: expand public information programs (repellent use, personal protection, source reduction, risk communication about adult mosquito control program); prepare to implement adult mosquito control if surveillance findings indicate the likely potential for human risk to persist or increase.

## **Level 4**

Definition: Spring/summer/fall; surveillance finding indicating high risk of human infection, (e.g. high or clusters of dead bird densities, high mosquito infection rates, multiple positive mosquito species, horse or other mammalian cases indicating increasing epizootic transmission, or a human case and high levels of epizootic activity) and abundant adult vectors.

Response: Respond as in level 3, plus: continue active surveillance for human cases; make final arrangements to implement adult mosquito control program in areas of potential human risk.

## **Level 5**

Definition: Spring/summer/fall; marked increase of confirmed multiple WNV cases in humans and conditions favoring continued transmission to humans.

Response: Respond as in level 4, plus: implement or intensify emergency adult mosquito control program; monitor effectiveness of adulticiding on target mosquito populations; coordinate adult mosquito control activities with surrounding jurisdictions. FCHD activities related to adulticiding will include the following:

- CDC and gravid traps will be added to the treated area of concern if additional surveillance data are required.
- FCHD will work with experts and the contractor to design and implement feasible measures to monitor the efficacy of the adulticiding activities.
- The public will be notified of adulticide schedules in advance. This will allow residents with special health concerns sufficient time to take any precautions to reduce pesticide exposure (see Public Education and Community Outreach).

- Hospitals will be notified regarding the adulticiding schedule. Information on the pesticide that will be used will be provided to the public, physicians and other health care providers.
- Adult mosquito control will be scheduled when mosquitoes are active and when weather conditions are conducive to its success.
- Information will be released in advance through the media, the FCHD WNV Web site and through news releases, the MSMS, as well as pertinent County and community organizations.

## **10. Resources**

The Fairfax County West Nile Virus Control and Mosquito Management Program is funded through the following resources:

### **Fund 116**

- 1 Entomologist (Program Manager)
- 2 Biologists
- 4 limited term staff (May through October)
- 4 Urban foresters (as duties allow)

### **General Fund (Health Department):**

- 1 (50%) Environmental Health Specialists (EHS III) – Outreach support
- 1 (15%) EHS III – GIS specialist
- 2 (10%) Administrative support
- 7 (5%) EHS II – Complaint support when necessary
- 2 (10%) Senior Administrative (CTC) coordination

### **Other departments, agencies and jurisdictions:**

Mosquito Surveillance and Management Subcommittee

### **MSMS Members**

City of Fairfax  
 City of Falls Church  
 Department of Public Works and Environmental Services (DPWES)  
     Maintenance and Storm Water Management Division  
     SPD (STW)  
     Forest Pest Management Program  
 Department of Management and Budget  
 Department of Information Technology  
 Fairfax County Park Authority  
 Fairfax Public Schools  
 Health Department  
 Office of the County Attorney  
 Office of Public Affairs  
 Police Department  
     Animal Control  
 Town of Herndon  
 Town of Vienna  
 Virginia Department of Transportation (VDOT)

## **11. Mosquito Control References and Links**

CDC

Pesticides and Public Health: Integrated Methods of Mosquito Management

<http://www.cdc.gov/ncidod/eid/vol7no1/rose.htm>

CDC and USEPA

CDC / USEPA Joint Statement on Mosquito Control

<http://www.epa.gov/pesticides/citizens/mosquitojoint.htm>

EPA

Using Insect Repellents Safely

<http://www.epa.gov/pesticides/citizens/insectrp.htm>

Larvicides for Mosquito Control

<http://www.epa.gov/pesticides/citizens/larvicides4mosquitos.htm>

Synthetic Pyrethroids for Mosquito Control

<http://www.epa.gov/pesticides/citizens/pyrethroids4mosquitos.htm>

VDH

West Nile Virus Web page

<http://www.vdh.state.va.us/epi/wnvsrplan/AvianPlan.asp>

Fairfax County Health Department

West Nile Virus Web Page

<http://www.fairfaxcountny.gov/fightthebite>

USEPA

Pesticides and Mosquito Control

<http://www.epa.gov/pesticides/factsheets/skeeters.htm>

USGS

U. S. Geological Survey

<http://westnilemaps.usgs.gov/>